

EEB Laboratory **Shanghai**

Summary and Action Plan

Energy Efficiency in Buildings



Partners of the EEB lab Shanghai



中国可持续发展工商理事会
China Business Council for Sustainable Development

About the WBCSD

The World Business Council for Sustainable Development (WBCSD), a CEO-led organization of some 200 forward-thinking global companies, is committed to galvanizing the global business community to create a sustainable future for business, society and the environment. Together with its members, the council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action. Leveraging its strong relationships with stakeholders as the leading advocate for business, the council helps drive debate and policy change in favor of sustainable development solutions. The WBCSD provides a forum for its member companies - who represent all business sectors, all continents and a combined revenue of more than \$8.5 trillion, 19 million employees - to share best practices on sustainable development issues and to develop innovative tools that change the status quo. The council also benefits from a network of 70 national and regional business councils and partner organizations, a majority of which are based in developing countries.

www.wbcSD.org

About CBCSD

CBCSD is the first organization in China to launch a sustainability reports collection and analysis mechanism. As an essential part of CBCSD's work, the project employs various forms of communication including sustainability report collecting seminars and international dialogues on best practices, to ensure economic, environmental and social benefits for enterprises.

Since 2005, CBCSD has consistently collected corporate sustainability reports, now amounting to approximately 2000 reports. The CBCSD database captures the development of corporate sustainability reporting from niche to widespread practice in China.

About GBPP

The GBPP (Green Building Professional Partnership) is a not-for-profit organization that locally coordinates with well-known green building councils, universities and other professional companies and organizations to disseminate their updates to the green building professional community in China. The GBPP is also a channel for green building professionals to build mutual communication with leading green building organizations.

WBCSD - EEB 2.0 project members:

LafargeHolcim (co-chair)	Infosys
United Technologies (co-chair)	Schneider Electric
AkzoNobel	SGS
ArcelorMittal	Siemens
Arcadis	Skanska
ENGIE	

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Summary



The Energy Efficiency in Buildings Laboratory (EEB Lab) in Shanghai convened a wide range of local stakeholders and international experts to investigate barriers and identify enablers for greater local market uptake of energy-efficient buildings. The Lab was organized by the World Business Council for Sustainable Development (WBCSD) together with the members and partners of its Energy Efficiency in Buildings (EEB 2.0) project.

The building sector in China is a pillar of the economy and has developed significantly since the year 2000. However, energy efficient products and equipment are not widely used in new construction. The building sector is still a highly competitive, low cost industry and stakeholders in building construction and operation phases may have conflicted financial interests.

SIGNIFICANT MARKET SIZE AND POTENTIAL

WBCSD chose Shanghai because of the size and the perceived condition of the real estate market, public interest in improving the country's energy security, and signs of an emerging interest in energy efficiency. Shanghai is the most populous city in China, with a permanent population of 238 million in an area of 1563km². It is a key location for maximizing the potential energy savings that can arise from the actions of the EEB Lab.

In Shanghai, buildings are responsible for well over 40% of final energy use. Improving energy efficiency in buildings therefore offers great opportunities to reduce emissions and meet climate challenges. Energy-efficient buildings can also deliver multiple benefits on national, sectoral and personal levels, such as improved energy security, employment, social and health advances

COMBATTING INCREASING ENERGY DEMAND

With the acceleration of China's urbanization and infrastructure construction, millions of people have moved from rural areas to the cities seeking a better life. The urbanization rate in China has risen from 37.7% to 53.7% (2001-2015) significantly. As a result, construction and building energy consumption are growing continuously.

GROWING ENVIRONMENTAL CONCERNS

Increasing energy demand presents China with serious environmental problems, including smog from energy production. In recent years, people have been paying more and more attention to energy saving and emission control as environmental concerns have become more prominent. Public awareness of energy efficiency and green development is probably now at its highest point for 30 years.

¹ SRIBS, <https://www.gigabase.org/en/designers/1287-sribs>

KEY ACTIONS FROM THE EEB LAB

During the EEB Lab, a team of experts representing the WBCSD member companies, regional stakeholders and global partners interviewed a cross section of Shanghai's real estate market, including developers, investors, designers, engineers, facility operators and tenants.

These discussions confirmed four key areas for action to transform energy efficiency, which were the focus of the EEB Lab sessions:

- Awareness and understanding of the multiple benefits of energy efficiency in buildings
- Workforce capacity – training and skills
- Financing energy efficiency solutions
- Policy and regulation

The table highlights the key actions in each area. EEB Lab partners have already collectively committed to implementing more than half of the identified actions (see page 22) and to working together to identify ownership for the remaining recommendations as members of a new Multi-Stakeholder Platform.

FOCUS AREA 1

AWARENESS OF THE MULTIPLE BENEFITS OF EEB

- Create targeted marketing and messaging to motivate regional real estate professionals to take action on energy efficiency.
- In particular, work in partnership to focus on benchmarking and promotion of best practice case studies.

FOCUS AREA 2

WORKFORCE CAPACITY & SKILLS

- Establish best practices around energy data management.
- Promote and emphasize the technical influence of contractors and building operation staff to attract new talent and invest in their technical education and training.

FOCUS AREA 3

FINANCING EEB SOLUTIONS

- Coordinate, foster development, and create greater access to energy efficiency financing options and tools.
- Support all financial tools, such as utility structured financing, incentives, and private sector financing options.

FOCUS AREA 4

POLICY & REGULATION

- Work with diverse regional stakeholders to develop public policy.
- Focus on creating appropriate policies and regulations that can be effectively implemented to promote data transparency and encourage the enthusiasm of the market to reach its full potential.





Energy Efficiency in Buildings: Scaling up Action



BUILDINGS ARE CENTRAL TO ENERGY SECURITY AND CLIMATE CONCERNS

Buildings are the largest energy consumers in the world, accounting for more than one-third of all final energy use and approximately 30% of global carbon emissions. Energy-intensive sectors such as transport and heavy industry are more visible, but buildings have a major role to play in any corporate or national strategy to tackle climate change. This is why the WBCSD created the Energy Efficiency in Buildings (EEB) project – it is one of the key areas for action on energy security and man-made contributions to climate concerns.

BENEFITS OF ENERGY-EFFICIENT BUILDINGS

Energy efficiency in buildings is a key contributor to achieving the imperative of keeping global warming below 2°C. But improving energy efficiency in buildings has many additional benefits.

Until recently, the calculated return on investment for energy efficiency in buildings was limited to the energy saved and associated cost savings. More effort is now underway to understand and monetize a wider range of benefits, including²:

- For building owners and occupants: improved durability, reduced maintenance, greater comfort, lower costs, higher property values, increased habitable space, increased productivity, and improved health and safety.
- For governments: improved air quality, reduced societal health costs, an improved tax base and lower budget variation, higher GDP and enhanced energy security.
- Utilities: cost and operational gains due to reduced customer turnover, reduced emissions and reduced system capacity constraints.

OVERCOMING BARRIERS TO TRANSFORM THE MARKET

The first EEB project identified how to overcome barriers to energy efficiency in buildings, following a four-year research project. The [Transforming the Market report](#) made recommendations and created a roadmap to transform energy use in buildings. Research showed that transformation requires action across the building industry, from developers and building owners to policymakers.

FROM RESEARCH TO ACTION IN EEB 2.0

The second EEB project (EEB 2.0) began in 2013 to implement the recommendations and stimulate change. Its goal is to unlock financially viable energy-efficiency investments that are not being realized because of financial, regulatory, organizational and other non-technical barriers. EEB 2.0 is working with local and international stakeholders to develop the business case for energy efficiency in buildings with different groups of decision-makers and to provide recommendations for action.

² Source: Extract from Energy Efficiency Market Report 2015, IEA adapted from IEA (2014a), Capturing the Multiple Benefits of Energy Efficiency, OECD/IEA, Paris

Figure 1: How to transform energy use in buildings



Source: Transforming the Market, WBCSD, 2009

ENGAGING TO ACTIVATE THE MARKET THROUGH EEB LABORATORIES

EEB 2.0 has developed a structured, replicable stakeholder engagement process to diagnose and tackle key barriers to energy efficiency in urban areas where commercial buildings are most concentrated. It is pioneering ten market engagements

1. Houston/US
2. Warsaw/Poland
3. Bangalore/ India
4. Jaipur/India
5. Rio de Janeiro/Brazil
6. The Netherlands & Belgium
7. Kuala Lumpur/Malaysia
8. Jakarta/Indonesia
9. Singapore
10. Shanghai/China

EEB 2.0 acts as a convener and facilitator, especially through the Energy Efficiency in Buildings Laboratory (EEB Lab), a three day workshop which aims to:

- Build a clear understanding of the market, identifying local barriers and enablers that could drive change;
- Define actions to overcome barriers and catalyze enablers to assist market transformation;
- Recruit key stakeholders to develop and implement an action plan for market-wide deployment.

The EEB Lab brings together local stakeholders and technical experts to pinpoint issues and priorities and create a coalition of actors who will drive transformation.

Check the EEB webpage for further information and Why and How to engage in Market engagements through the [EEB Labs](#).

his report presents the activities and outcomes of the Shanghai EEB Lab in February, 2016, initiated by WBCSD together with the Green Building Professional Partnership-China and China BCSD.







3

The EEB Laboratory process

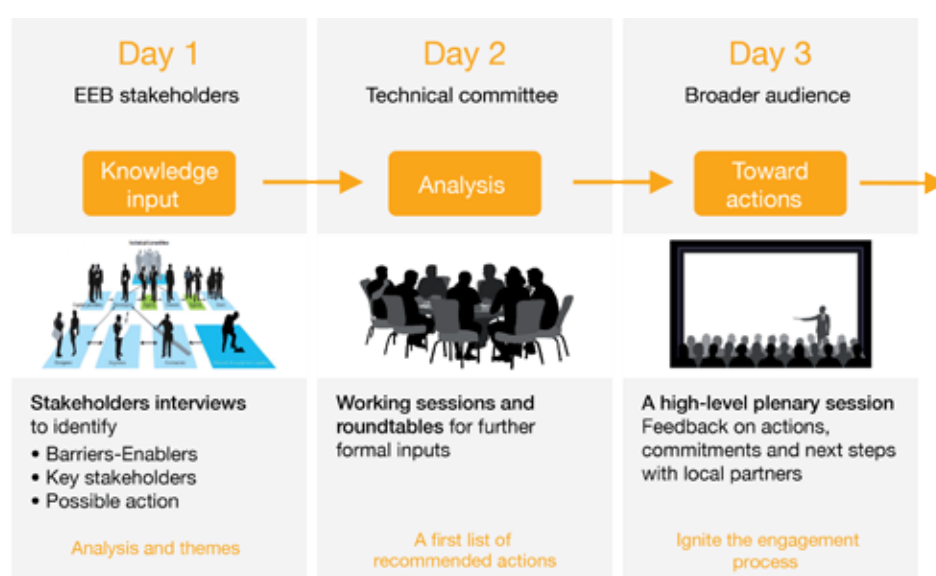
THE EEB LAB PROCESS

Overview

The EEB Lab aims to get a clear understanding of the market situation and, with the help of a panel of experts, recommend and initiate action.

The Lab benefited from extensive preparation and the involvement of national and local partner organizations. It took place over three days early in 2016. On day 1, a panel of experts, the Technical Committee (see p 14), interviewed more than 100 stakeholders and analyzed their contributions to identify common themes. This work fed into Roundtable discussions on day two. The final day brought together all participants and other invited guests in a closing plenary session. They discussed conclusions and sought commitment from participants to take action on the opportunities for improvement identified during the Lab.

Figure 2: The EEB Lab concept



Preparation

Several months ahead of the EEB Lab, a Steering Committee began to identify relevant stakeholders, recruit experts and “thought leaders” and plan the event.

MARKET REVIEW

A market review was commissioned to describe the current state of energy efficiency in the Shanghai real estate market and provide background information. It was presented to the Technical Committee during a meeting/webinar in preparation for the EEB Lab.

TECHNICAL COMMITTEE

A Technical Committee is central to an EEB Laboratory. It brings together national and international experts who help to define the specific Lab objectives, carry out interviews with local stakeholders, and consolidate findings into meaningful recommendations for commitments and action. The Technical Committee in Shanghai consisted of 60 experts (see Table 1 and the appendix for details of partners).

During a preparatory meeting prior to the EEB Lab, the Technical Committee discussed the current market situation, identified key stakeholders to involve, and set the agenda and participant list. The preparatory meeting identified these targets for the Shanghai EEB Lab:

- Demonstrate the benefits of energy-efficient buildings to convince and commit stakeholders to invest in energy efficiency
- Deliver a tangible energy efficiency in buildings action plan for Shanghai
- Launch a self-sustaining stakeholder network with knowledgeable and skilled people who can connect with governmental organizations that will continue to drive a progressive agenda for energy efficiency in buildings.

Table 1: Organizations represented on the EEB Lab Technical Committee

NAME	ORGANIZATION
Barbara Ex	Business Development Director, EQUOTA Energy
Beihong Zhang	Deputy General Manager, Department of Building Innovation Technology, Shanghai Research Institute of Building Science
Bin Wang	L'Oreal Asia EHS & Facility Director
CenXi Yuan	Director, Shanghai Changning District Low Carbon Management and Development Center
Claudia Schweixer	Manager, Sustainable Cities, WBCSD
Clay Nesler	VP, Global Energy & Sustainability, Building Efficiency, Johnson Controls
Cottee Hua	GBPP,COO, Director of Ecoface
Dan Dan Wang	Technical Supervisor, EMSI, UTC
Dong Xu	Director, Energy Efficiency, Business Development, Siemens China
Emma Chen	Business Development Manager, Greater China, Solidiance
Erin Rowe	Freelance Energy Consultant
Fangji Wu	China Regional Manager of Eaton Corporate Research & Technology
Gary Lee	GBPP,CPO, Director of Sustainability, Bureau Veritas
Greg Yager	City Executive, Shanghai, Senior Vice President, Global Director , Planning and Urban Design, Arcadis
Guodong Ye	Director, Green Building, China Merchants Group
Hong Miao	China Energy Program Lead, WRI
Hongbo Qin	Director, Strategy Development Department, Shanghai Energy Efficiency Center
Hui Zhang	Director, Community Affairs, Asia, UTC

NAME	ORGANIZATION
Huijuan Han	ESER
Jeffrey Yuan	Head of Environment, Arcadis China
Jiang Song	Energy Engineer, Siemens China
Jianqing Ruan	GBPP, Shanghai Industrial Finance Investment Co., Ltd
Jianzhou Liu	Deputy Director, Department of International Cooperation, Shanghai
Jiexin Li	China Program Lead, Architecture 2030
Jinlei Ding	Group Leader, Thermal & Building, United Technologies Research Center (China) Ltd.
Kang Qi	Deputy Chief Engineer, ESER
Ken Rhee	Chief Representative, Mainland China, ULI
Lijia (Jessica)	Marketing Manager, AdvanTE3C
Zhao	Solution Center Asia, UTC
Ma Yuqiu	VAP Business Director, LafargeHolcim China
Marion Berger	Communication & Sustainability officer – Rexel Asia Pacific
Ming Liu	Research Engineer, Disney Research China
Murilo Bonilha	General Manager, United Technologies Research Center (China) Ltd.
Peng Xu	Professor, School of Mechanical Engineering, Tongji University
Quiing Zhang	Saint Gobain
Qin Mao	Director, Shanghai Changning District Low Carbon Management and Development Center
Roland Ullmann	Director Industry Affairs, Building Automation, Siemens Switzerland Ltd
Rolf Demmer	Director, SoftGrid (Shanghai) Co., Ltd, Project Partner of LUWOGE consult GmbH
Rong Wu Jie	Vice President, XianDai Architectural Design Institute and ASSC
Wei Liu	BD Manager, EMSI North
Wei Tian	Xiandai Architecture Design Institute
Weifeng Zhu	General Manager, Shanghai Jianke Building Energy Service Co., LTD
Wen Ding	Director, Communication, United Technologies Management (Beijing) Company Ltd.
William Sisson	Senior Director Sustainability United Technologies Research Center, Co-chair, EEB, WBCSD
Xiaochao (John) Zhang	Marketing Manager, Home Segment, Strategy and Business Development, Schneider
Xiaotong Gao	Building Physics Platform Leader, Saint- Gobain Research (Shanghai) Co., Ltd
Xu Xuan Ming	Siemens China

NAME	ORGANIZATION
Xuqun Chen	Senior Secretary, SoftGrid (Shanghai) Co., Ltd, Project Partner of LUWOG CONSULT GmbH
Yan Zhou	Chair & CEO, GBPP
Yanli Liu	BASF
Yao Lu	GBPP, Marketing
Ying Jin	ESER
Yuan Fang	Director, Green Building, SOHO
Yunjie Xu	CSR Manager, China Mobile
Zhehan Shang	GBPP, Idea
Zhiming Pan	Building Energy Efficiency Specialist, NRDC
Zhipeng Yan	New Jersey Institute Technology
Zhulin Zheng	Senior Engineer, Department of Building Innovation Technology, Shanghai Research Institute of Building Science
Zhuoya (Zora) Chen	Public Affairs Manager, Government Affairs, Eaton (China) Investments Co., Ltd.
Ming Liu	Research Engineer, Disney Research China



INPUTS FROM THE INTERVIEWS

Interviewees were asked to complete a questionnaire providing background information to support the Lab process. Their responses are summarized here.

Energy Efficiency in Buildings (EEB) was of significant importance to interviewees, with an average score of 4.2/5, increasing to 4.6/5 when viewed over the next 3-5 years. EEB was most important to large international material suppliers, followed by architects and design consultants.

The lowest significance rating came from developers, who frequently had no specific company policy on energy efficiency in buildings. Commercial developers all recognized the potential positive business case for energy efficiency, but stated that low awareness among customers results in no sales premium for green buildings.

More than half of surveyed architects quoted the positive business case for EEB. Architects rated energy efficiency in buildings as having medium importance for their customers (contractors, developers and investors/home buyers) but as becoming increasingly important, especially in reference to green building certification systems.

Material suppliers had energy-efficiency policies in place covering their own facilities, usually including production facilities, with environmental concerns and the positive business case for energy efficiency being the key drivers.

Few capital providers responded to the survey, which makes it difficult to draw conclusions. But it is worth highlighting the response from one international investment management company, which stated that energy efficiency in buildings is a key concern for their firm and will become even more important over the next 3-5 years. The firm has introduced asset-level business plans for existing properties that incorporate measurable targets for reducing energy consumption and waste.





Day 1 EEB Stakeholders – Knowledge input

A range of organizations presented 15 Case studies on the practice of energy efficiency in buildings.

Table 2: Organizations submitting case studies to the EEB Lab

Architects, design, consulting	Material/ components providers	Owners	Government
China Academy of Building Research	Siemens	L'Oreal	Shanghai Center for Energy Saving and Emission Reduction
Shanghai Institute of Building Energy Service Co.	BASF	SOHO China	Shanghai Changning District Low Carbon Management and Development Center
UD Architectural Design	Schneider Electric	Shanghai Mobile	
	Johnson Controls	Shanghai IFC	
		EATON Center	



EXAMPLES OF CASE STUDIES IN THE EEB LAB

The case studies helped Lab participants to understand the current situation in EEB Awareness, Capacity, Finance and Policy. They demonstrated the barriers over the four focus areas and identified trends and progress in energy efficiency building market development. Four example case studies are outlined below.

1. AWARENESS ON ENERGY EFFICIENCY

Case: Ecologic Art Exhibition Hall in Chongming (Chongming Energy Center)

Speaker: WujieRong ECADI&UD



This case introduced a Chongming Energy Center project covering basic design concepts, suitable technology and architectural values. The building made use of a variety of energy-saving technologies, such as natural ventilation (double walls, rotating windows, ventilation towers), photovoltaic integration, casing construction, light pipe technology, natural lighting, and shading louvers.

2. CAPACITY AND CAPABILITY ON ENERGY EFFICIENCY

Case: Public Building Energy Efficiency Situation and Promotion in Shanghai
Speaker: Beihong Zhang, Shanghai Research Institute of Building Sciences

This case introduced the current status and growth factors for building energy consumption in Shanghai city, and the EEB governance objectives in the 13th five year plan.

It outlined the monitoring and application of Shanghai building energy consumption in the context of:

- The local regulatory system,
- Public building energy consumption monitoring and information platforms,
- Application of energy consumption monitoring data.

This case also introduced the promotion of energy saving in public buildings through retrofit, including the most significant demonstration cities and the impact of demonstration projects.

3. INVESTMENT AND FINANCING STRATEGIES

Case: Siemens exhibition cases and zero energy consumption buildings case study
Speaker: Mingxuan Xu, Siemens

This case featured a 700,000 square meter exhibition center, with barriers to energy efficiency such as varied operating hours, size, load and irregular occupancy levels.

The complex systems with massive capacity required sophisticated control logic to ensure continuous operation of a high efficiency cold station system that could deal with a pavilion load with large and rapid variations. Timely and accurate operation and adjustment of the cold station system according to load fluctuation and equipment characteristics is required to avoid energy waste.

Using an Energy Performance Contracting (EPC) model, Siemens implemented an energy-saving retrofit to air conditioning systems, cooling stations, ventilation systems and lighting systems. It reduced the overall energy consumption of cooling stations by 15%, ventilation systems by >40%, and outdoor lighting systems by 30%. An initial investment of 10 million RMB and a contract period of 5.5 years gave the customer energy saving benefits of 2.5 mKWh per annum.

4. POLICY AND REGULATIONS

Case: Regulation Policy Research on Public Building Retrofit in Shanghai Changning District
Speaker: Ying Jin, Shanghai Center for Energy Saving and Emission Reduction

This case introduced the growth of building energy consumption in China and particularly the energy consumption growth of public buildings in Shanghai during the 12th five year plan period.



A series of initiatives have been introduced over the period, including:

- Public building energy efficiency guides and specific support policies
- A focus on research and composition of the standard specification and technical guidelines for green building materials in Shanghai
- Assessment of green buildings
- An index system of green eco-city control³
- Promotion of 10 million square meters of public building transformation

The energy consumption per unit of construction area of Shanghai public buildings fell by 8-10% during this period.

Day 2 – Analysis and discussion

The Technical Committee analyzed the 15 case studies to understand market barriers and opportunities. The analysis helped to identify priority market barriers and recommendations for action.

Day 3 – Plenary

The Lab culminated in a closing plenary, discussing the significant opportunities in the market and the key findings from the session. It produced a call to action for Shanghai to take forward the momentum developed during the Lab to move the market. Approximately 50 Shanghai-area business leaders and experts took part.

Table 3: Agenda of the plenary session

PLENARY OPENING

Master of Ceremony: Professor Xu Peng, Tongji University
Speakers: Claudia Schweizer, Sustainable Buildings Mgr WBCSD;
William Sisson, Director, Sustainability United Technologies, Co-chair WBCSD EEB project;
Gan Zhongze, Chairman Shanghai Green Building Council

THE BUSINESS CASE FOR ENERGY EFFICIENCY

Moderator: Ken Rhee, Urban Land Institute
Speakers: Beihong Zhang, Shanghai Research Institute of Building Science;
Bin Wang, L'Oreal Asia;
Guodong Ye, China Merchants Group;
Wei Tian, Shanghai Xiandai Archi-Scientific Creation Center;
Wujie Rong, Xiandai Architecture Urban Design Institute

KEY FINDINGS FROM THE EEB LABORATORY

Moderator: Prof. Peng Xu, Tongji University
Speakers: Murilo Bonilha, United Technologies Research Center;
Greg Yager, Arcadis, Dong Xu, SIEMENS;
Fangji Wu, Eaton Corporate Research and Technology.

WRAP UP & NEXT STEPS

Moderator: William Sisson Director, Sustainability, United Technologies, Co-chair, WBCSD EEB2.0 project
Alexandre Jeandel, Corporate senior advisor, Sustainable Development Strategy, ENGIE, company lead for the South East Asia EEB labs

³ The Eco City Index is released by the Chinese government for managing development areas. It must be complied with by developers wishing to work in the area.



Analysis and Recommendations



China has many successful examples of buildings with excellent energy performance and low investment that demonstrate the business case for implementing energy efficiency measures. However, there are still many barriers in the four key areas of EEB Lab action.

This section presents the key outcomes and recommendations for action under the four core topics, derived from the learning from cases studies presented on Day 1 and the roundtable discussions on Day 2.

Focus area 1 **Boosting regional awareness on energy efficiency**

Addressing the environmental and financial benefits of energy efficiency in buildings is a significant challenge while the marketplace is driven by maximizing profit margin. It is therefore essential to increase end users' awareness of the benefits of energy efficiency to stimulate market demand and achieve price premiums for highly energy efficient buildings.

MARKET BARRIERS

- **LACK OF ACCESS TO RELIABLE DATA AND BENCHMARKING**

There is currently a lack of available, reliable and accessible data on the energy performance of buildings. Data is not sufficiently accurate, accessible or complete. This prevents benchmarking with reference to both local and international case studies. There is no open source energy index information covering different geographies and climate conditions.

- **MISPERCEPTIONS OF THE ECONOMICS OF EEB**

Energy Efficiency in Buildings is still misperceived and considered "too expensive" from a construction and operations perspective. Energy efficient buildings can currently cost an additional 20% to 30% to build, with payback on investment in around 3 to 5 years. The perception of building developers and owners is that implementing a high degree of energy saving measures will impact their operating profit.

In projects which are not owned by developers, the initial investment in energy efficiency will be reduced to meet minimum requirements as there is no mechanism for the rewards of energy efficiency in the occupancy period flowing back to the developer. Building owners are not willing to implement post-occupancy energy retrofit at the cost of temporary reduction in non-occupied leasable space.

- **LACK OF HOLISTIC MODELS INCLUDING DESIGN-M&E-SUPPLIERS ETC.**

Stakeholders involved in the construction and development of buildings work in "silos" with poor communication between the various specialists. There are no holistic operational models covering the full supply chain from designers and engineers to builders, operators and end users.

- **LACK OF COLLABORATION AND COOPERATION AMONG THE SUPPLY CHAIN**

The building and construction sectors are characterized by fragmentation in the supply chain. A lack of trust prevents collaborative approaches and shared information (even when pre-competitive). This lack of effective engagement is seen in both the private and public sectors.

RECOMMENDATIONS FOR ACTION

Introduce energy efficiency labelling

- Promote a labelling program for residential and commercial buildings according to their energy performance. Energy audits could be performed pre-let and resale, similar to Energy Performance Certificates (EPCs) in the European market.

Run seminars with professional societies and organizations, commercial developers and government officials to promote best energy efficiency practices in buildings.

- Partnering with organizations and professional associations with the support of government officials would promote energy efficiency principles and best practices. Seminars to promote energy efficiency in buildings should be created to engage the public as well as for a professional audience.
- Potential partners could include: GBPP (Green Buildings Performance Partnership), AIA (American Institute of Architects), ULI (Urban Land Institute), RIBA (Royal Institute of British Architects), Architecture 2030, Shanghai Design Institutes, the China Society of Architects, academics and financial institutions.

Promote Energy Efficiency as part of CSR in Chinese and International companies.

- Promoting energy efficiency in buildings as part of companies' CSR would increase commercial awareness of energy efficiency measures. Internal monitoring and reporting regularly to top management would improve building energy efficiency and encourage energy efficient behavior.
- A particularly topical issue would be to relate energy efficiency improvements to wellbeing and local air quality. This was frequently raised during the EEB Lab as an important topic for employees.

Highlight best practice and name and shame unsatisfactory performance

- Successful case studies and award programs should be put in place to encourage best practice. It is also essential to raise awareness of the poor quality of energy efficiency standards common in the market today. Case studies of poor building types currently being built should be identified to educate the public on the inefficiency that current projects will lock in. These are the building types that most people live, work, shop and relax in.

Focus area 2 Boosting workforce capacity and capability on energy efficiency

MARKET BARRIERS

- **DESIGNERS: LACK OF INTEGRATED DESIGN CAPABILITY**

Shanghai buildings too often lack an integrated design process. Design, construction and operations maintenance are completed by different companies at different stages, without a unified working framework and technical coordination from the start. Architects generally design in accordance with specifications without significant experience in the operations management of buildings.

Even when Building Information Modeling (BIM) software is being used for green buildings, the implementation is carried out in silos. There is a clear need for an advanced implementation procedure with an early collaboration model that can have a major influence on the impact of a building during its use phase.

- **CONTRACTORS: LACK OF TRAINING AND CAPABILITY TO INSTALL AND MAINTAIN ENERGY EFFICIENCY SOLUTIONS**

Product installation needs care and understanding. Contractor skills are often very basic and there is a lack of broader understanding of the products' intended operation. This is often reflected either in product damage or inefficient use.

Contractors do not invest in continuing professional development with a long term perspective. They often come from rural areas without significant skills and move quickly to other positions.

- **OPERATORS: LOW CAPABILITY TO OPERATE INTEGRATED / ADVANCED SYSTEMS**

Effective operation of buildings is a huge missed opportunity in Shanghai. There are many examples of buildings with LEED Gold certification that are not well maintained or used effectively. As a result, systems such as shutters and swimming pool controls fail or are not used due to lack of trust. Energy efficient products therefore frequently fail and require replacement after 3-5 years.

Decisions on product choice often do not take a life-cycle approach. This aspect is driven by the limited capability for operating advanced and integrated systems and by owners' low expectations because they are unaware of best practices or demonstration projects.

- **MANAGERS : LIMITED PROJECT MANAGEMENT PROFESSIONALS AND IMMATURE PROCESSES**

Good project management with clear processes is not yet in place in Shanghai. These aspects are critical and should be considered in training professional managers who handle supply chain interaction and coordination.

RECOMMENDATIONS FOR ACTION

Work with local Green Building Councils (GBCs) to promote project management capability and training.

- The China and Shanghai Green Building Councils have extensive experience in delivering training and developing training material and tools. Training and education programs for the full building supply chain (owners, designers & design institutes, contractors, suppliers, program managers, engineers and contractors) should be encouraged, using GBC material such as online tools and updates on new low energy solutions.
- A specific program should target building owners to improve EEB contract specificity. Guidelines and templates should be developed to assist a tendering process that is not yet mature enough to realize significant EEB savings.
- Companies with successful implementation history should be featured as case studies in training materials.

Make contractor jobs more attractive by investing in education and training with a technological emphasis

- Investment in education with an emphasis on technological aspects of EEB should develop unskilled contractors' capabilities and improve their job prospects. This would help workers to deal with sometimes complex interlinkages between EEB products.
- A new approach to performance-based contracting should support long-term employment.

Promote re-commissioning (Cx) and develop Auto-Cx processes and tools

- Plans for recommissioning buildings to reduce energy costs and GHG emissions should be promoted to improve the performance of buildings that are not currently well equipped or maintained.
- Yearly re-commissioning post-occupancy is an important means to ensure energy saving effectiveness. Building Automation (BA) systems can develop appropriate self-commissioning programs and tools (dependent on BA system manufacturers improving their technical capabilities).

Focus area 3 Investment and financing strategies

MARKET BARRIERS

- **A SCALABLE ESCO (ENERGY SERVICE COMPANY) MODEL IS IMMATURE**
ESCO models are a new concept in China and not yet well funded or developed.

- **LACK OF FINANCIAL SUPPORT FOR ENERGY PERFORMANCE CONTRACTING (EPC) PROJECTS**
EPCs are primarily implemented by ESCOs. They can achieve improvements to facilities that lack energy engineering skills, manpower, management time, capital funding, understanding of risk, or technology information. EPC projects use the income stream from cost savings to fund energy upgrades and repay the cost of the investment.

As ESCOs are often poorly funded they focus mainly on short payback projects that repay their initial capital rapidly so it can be reinvested.

- **UNSTABLE PERFORMANCE GUARANTEES**
EPCs transfer technical and financial risks from the customer to the ESCO based on performance guarantees given by the ESCO. Building owners are risk averse and there is not yet sufficient evidence of cost savings provided by these schemes.

Performance measurement is not yet reliable enough in Shanghai. EPC performance should be measured, verified and monitored in relation to the agreed level of energy efficiency improvement or other agreed energy performance criteria (such as financial savings).

- **TENDERING MODELS ARE UNCLEAR**
Lack of clarity in the tendering process leads to uncertainty and misunderstanding and is a major source of claims and disputes at the construction stage. The tender model often does not include clear technical specifications of what the client wants to build.
- **LOW ENERGY COST OF BUILDING OPERATION**
The low cost of energy and uncertain future level of energy prices are major barriers to the rapid development of energy efficiency. Energy price changes impact the technology strategy and return on investment of energy saving measures. The uncertainty makes equity financing difficult.

RECOMMENDATIONS FOR ACTION

Increase financial support for Energy Performance Contracting (EPC) projects.

- Non-banking models of finance such as leasing by equipment vendors would help to push competitive rates of interest.
- Short term loans could close the gap between project completion and government subsidies (Peer to Peer lending is one source of equity that could be considered).
- Support from banks for a special design concept to promote financing of asset-light ESCOs that would otherwise be unable to access mainstream bank loans.

The Globalchange [Market Opportunity Analysis White Paper](#) outlines the markets, trends, resources, challenges and opportunities for EPCs in both China and the U.S. The Globalchange EPC [Toolkit](#) identifies existing resources to assist facility owners and operators, practitioners (energy management companies, service and technology providers) and financial institutions in selecting, developing and executing EPC projects. Both of these resources should be promoted in Shanghai.

Improve performance guarantees

- A more detailed EPC performance measurement standard should be developed to improve the credibility of performance contracts
- Enhance 3rd party design solutions for EPC projects. Separating the design and installation phases of an energy efficiency project would help to ensure that installed equipment is as specified in the design phase.

Incentivize energy efficiency

- Increase the electricity tariff and separate rents from energy consumption so that energy costs are more visible. A new model should adjust electricity billing according to the energy saved in the building through EEB projects.
- Significant consumers should be penalized if they breach standards or benchmarks.

Focus area 4 Making policy and regulations more transparent and effective

MARKET BARRIERS

- **DATA TRANSPARENCY AND RELIABILITY**
There is little data available on the energy consumption of different types of buildings and what is available is often unreliable. Aggregated data on energy consumption/energy performance is particularly rare and is needed as a basis for financing decisions and communication.
- **POLICY IMPLEMENTATION AND ENFORCEMENT**
Building regulations and standards relating to energy efficiency performance are not mandatory.
Monitoring of implementation is inadequate and there is no assessment of policy impact.
- **LACK OF SYSTEMATIC POLICIES IN A CLEAR AND CONSISTENT ROADMAP**
Policy incentives for energy efficiency are usually implemented without continuous policy planning. Such policies are usually issued to follow the five-year plan or central or local policies for increasing economic growth. Policy uncertainty introduces risk to the economic return calculations of energy saving projects.
- **LACK OF DIVERSIFIED FINANCING SOURCES FOR EEB INCENTIVES**
The main funding of energy saving projects is from building owners carrying out renovation projects, ESCOs and government subsidies. Projects require a 3 to 5 year payback on investment for ESCO's to obtain government subsidies, limiting ESCO funded retrofits to low hanging fruit.

RECOMMENDATIONS FOR ACTION

Improve data transparency and reliability

In China most private and government building owners are unwilling to release data on their buildings. Policy and regulation could help to promote data sharing, creating performance benchmarks and increasing the ambition for energy efficiency in buildings. Actions:

- Push to build a data acquisition and energy monitoring system. Improve data consistency and completeness.
- Establish data management regulation and a legal framework for data (protected if necessary).
- Publish data, subject to privacy considerations and legality.

Strengthen policy implementation and enforcement

Government investment in buildings and construction should be aligned with policy guidelines for energy efficiency in buildings. Often there is no consultation before legislation is issued. Where as pre-disclosure could aid planning. Actions:

- Establish an energy consumption quota mechanism to incentivize energy performance.
- Publish certificates and EEB commendation badges to promote high performance buildings, giving positive publicity to the owner or developer and enhancing their brand value.

- Involve diversified international players to maximize the breadth of opinion in policy formation and include all building market stakeholders.

Develop more systematic policies

Actions:

- Build EEB policy alignment with the China Five-Year-Plan.
- Analyze policy trends and collect market feedback through industry associations.

Diversify financing incentives

Improve the reward management mechanism between building market stakeholders. Actions:

- Promote a comprehensive study on EEB incentives with finance specialists.
- Formulate incentives that cover the life cycle of EEB projects.
- Promote reward mechanism pilot projects.

NEXT STEPS

A new energy efficiency platform, Energy Efficiency in Buildings – Shanghai, will support four working groups to drive Shanghai forward and increase energy efficiency investment opportunities. The WBCSD, CBCSD and GBPP are managing this program around each of the four focus areas of the EEB Lab and will build additional support to continue these initiatives beyond 2016. GBPP will lead this effort.

A committee has been formed for each focus area, with a chairperson to lead the development and coordination of activities. Each working group has a diverse mix of energy efficiency market participants representing building owners, operators, equipment vendors, tenants, the public sector, and energy efficiency consultants.

The work will:

- Define the scope of each committee as it develops action plans;
- Coordinate and lead regular meetings to keep committees on track and update the program status;
- Provide resources and data to committees to help develop action plans
- Develop and lead a plenary or workshop to report on action plans and guides.

Table 4 recaps and elaborates the EEB Lab recommendations. Four working groups are taking actions forward. Their first task is to clarify objectives and identify leaders for the actions.



Table 4: : Next steps

Actions recommended during the EEB Lab	Action Plan to be implemented by the EEB Platform Committees
<p>Awareness</p> <ol style="list-style-type: none"> 1. Energy efficiency labelling 2. Seminars to promote EEB using case studies 3. Promote Energy Efficiency as part of CSR 4. Highlight best practice and name and shame unsatisfactory performance 	<p>Activities</p> <p>Work with Shanghai GBC to promote an energy efficiency labeling system for residential & commercial buildings.</p> <p>Encourage companies to develop and publish case studies that substantiate the learning from the EEB Lab (for new-built and retrofit energy-efficiency projects).</p> <p>Foster a collaborative approach with property owner associations to share and disseminate information via workshops and seminars.</p> <p>Run seminars engaging real estate developers and government officials in at least three districts in Shanghai.</p> <p>Establish strategic partnerships with CSR NGOs and media to engage Chinese companies.</p> <p>Develop a collection of case studies and material that can be used by all the major actors in the energy efficiency value chain to develop cost-effective, sustainable energy efficiency programs.</p> <p>Promote EEB best practice cases on local websites and media.</p>
<p>Workforce capacity</p> <ol style="list-style-type: none"> 1. Work with the Shanghai GBC to promote project management capability and training. 	<p>Identify, assess and recommend best practices in energy data management to strengthen building operators' capacity to interpret and evaluate data.</p> <p>Develop and recommend training materials relevant to specific target groups</p> <p>Work with Shanghai Green Building Council to promote project management capability and training with a specific focus on deployment of green building solutions to the target groups of designers, developers, and facility managers.</p> <p>Publish a white paper to capture best practices in the application of building information modeling (BIM) and integrated design processes in the China context. Promote the white paper to architects and designers through networks of professional organizations.</p> <p>Provide knowledge sharing capability on Green Loans and other financial instruments available for energy efficiency projects to ESCO companies and Energy Assessors.</p>

Actions recommended during the EEB Lab

Action Plan to be implemented by the EEB Platform Committees

Workforce capacity

2. Make the contractor job more attractive by investing in education and training with a technical emphasis.

Develop case studies and guide books for building operators to optimize building operation and maintenance practices.

Promote and emphasize the technical influence of contractors and building operations staff to attract new talent and invest in their technical education and training, for both new entrants and experienced professionals.

Identify, assess, and recommend training organizations and universities to provide and develop relevant training materials.

Use hands-on training sessions for contractor/facility manager / owners /Energy Management Companies.

3. Promote re-commissioning (Cx) and develop Auto-Cx processes and tools.

Identify case studies and guide books for building operators to optimize building operation and maintenance practices.

Develop Auto-Cx process and tools for building operators to demonstrate the benefits of energy efficiency projects for building owners.

Develop energy assessor training for green loan professionals in the banking industry.

Identify and/or develop a business case development tool which summarizes the benefits of an energy efficiency project; for building operators to convince building owners and developers.

Financing

1. Increase financial support for EPC projects

- A. Non-banking: e.g. financial leasing

Explore financing options and innovations including broader utility structured financing, incentives and broader private sector financing options. Push relevant stakeholders to issue a feasibility study report on financial incentives.

- B. Consider short term loans to close the gap between project completion and government subsidies.

Initiate a study of non-governmental barriers and promote a feasibility study on short term and small loans.

- C. Get banks' support for a special financial structure for asset-light ESCOs.

Advocate intense communication approaches between the banking industry and energy-saving associations, i.e. professional technical support via knowledge exchange seminars.

Lobby professional institutions to issue feasibility studies on green loan processes, especially for the asset-light ESCO model.

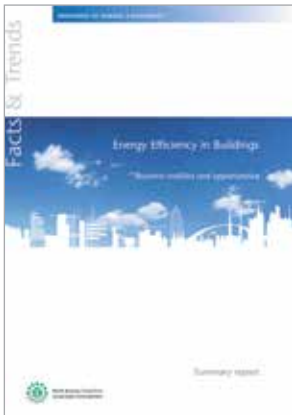
Encourage researchers to compile, assess and recommend financing tools to support financing due diligence that will support investment decisions.

Initiate comprehensive research on business cases and templates that can help building owners gain access to credit.

Actions recommended during the EEB Lab	Action Plan to be implemented by the EEB Platform Committees
Financing	
<p>2. Strengthen performance measurement and guarantees</p> <p>A. Develop a more detailed measurement standard</p> <hr/> <p>B. Enhance 3rd party solutions for EPC projects</p> <hr/> <p>3. Incentivize energy efficiency</p>	<p>Develop workshops that bring energy efficiency solution providers and financiers together to highlight critical information relating to performance standards which could help an energy efficiency project gain access to financial support.</p> <hr/> <p>Raise awareness among policy makers and recommend professional institutions develop design codes which facilitate design improvements at the early stage of an EPC project. Potential partners are SRIBS, Tongji university and JLL.</p> <p>Organize specific training for designers via a professional design platform.</p> <hr/> <p>Promote a policy effectiveness study on electricity tariff changes to incentivize energy saving behavior.</p>
Policy and regulation	
<p>1. Data Transparency and Reliability</p> <ul style="list-style-type: none"> • Build a data acquisition & energy monitoring system • Improve data consistency & completeness • Establish data management regulation • Publish data, subject to privacy and legality <hr/> <p>2. Policy Implementation and Enforcement</p> <ul style="list-style-type: none"> • Establish an energy consumption quota mechanism • Publish certificates and badges • Involve diversified International players <hr/> <p>3. Develop Systematic Policies</p> <ul style="list-style-type: none"> • Build Alignment with China's Five-Year-Plan • Build a roadmap of policy trends <hr/> <p>4. Diversify Financing Incentives</p> <p>Improve the reward management mechanism to minimize split incentives across the buildings value chain.</p>	<p>Promote seminars engaging government agents in three Shanghai districts.</p> <p>Recommend appropriate policies and regulations that can be effectively implemented to promote data transparency and arouse the enthusiasm of the market to achieve its potential.</p> <p>Promote studies on EEB incentive recommendations and building energy consumption data collection by research institutes.</p> <hr/> <p>Organize technical seminars involving diverse stakeholders, to promote an Energy Consumption Quota Mechanism in Shanghai.</p> <p>Shanghai EEB Lab policy committee to lobby for supportive local and national policy.</p> <hr/> <p>Emphasize the importance and necessity of policy consistency and roadmaps through joint events with local government and industry associations in Shanghai.</p> <p>Analyze policy trends and collect market feedback through industry associations.</p> <hr/> <p>Promote a comprehensive study on EEB incentives with finance specialists.</p> <p>Formulate incentives that cover the life cycle of EEB projects.</p> <p>Promote a reward mechanism pilot projects.</p>

APPENDICES

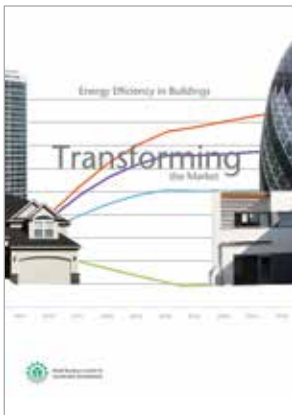
The WBCSD's EEB 2.0 project



In response to climate and development challenges in the building sector, the World Business Council for Sustainable Development (WBCSD) initiated the cross-industry Energy Efficiency in Buildings (EEB) project. In the first phase, from 2006 to 2010, the EEB project sought to create an understanding of both the challenges and the opportunities within the global building sector.

The project's first achievement was the publication of the Facts & Trends summary report, which combines the findings from research existing at the time of the project and stakeholder dialogues during hearings, workshops and forums with a breakthrough market research study that measures the stakeholder perceptions of sustainable buildings around the world.

The project's second milestone was the publication of its second report, Energy Efficiency in Buildings: Transforming the Market, launched in 2009. The report is based on a unique simulation model that analyzes the energy use of thousands of building types and millions of existing and new buildings, both commercial and residential. This model shows how energy use in buildings can be cut by 60% by 2050, which is essential to meeting global climate change targets. But this will require immediate action to transform the building sector.



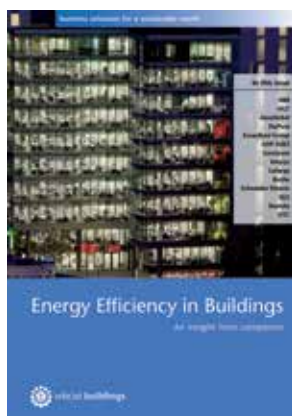
Finally, the EEB project also developed a roadmap setting out the key actions in the short and medium term for the seven groups that can contribute to meeting this challenge, ranging from investors to government authorities. The roadmap is an addendum to the main report, Transforming the Market.

See: <http://www.wbcd.org/work-program/sector-projects/buildings/eeb-first-phase.aspx>

WBCSD'S VISION 2050 SEES "9 BILLION PEOPLE LIVING WELL, WITHIN THE RESOURCE LIMITS OF THE PLANET BY 2050."

As this 2050 timeline is too distant for businesses to plan against, the WBCSD launched a stepping stone initiative, Action 2020, which has identified priority areas for business action that are based on scientific facts and social trends. A societal "Must-Have" has been set for each priority area that business solutions should work towards achieving by 2020.

The Energy Efficiency in Building 2.0 project will contribute to the climate change "Must-Have" by working with member companies to dramatically reduce the energy consumption of new and existing buildings.



CLIMATE CHANGE "MUST-HAVE"

With the goal of limiting global temperature rise to 2°C above pre-industrial levels, by 2020 the world must have energy, industry, agriculture and forestry systems that simultaneously:

- Meet societal development needs;
- Are undergoing the necessary structural transformation to ensure that cumulative net emissions do not exceed one trillion tonnes of carbon;+ peaking global emissions by 2020 keeps this goal in a feasible range;
- Are becoming resilient to expected changes in climate.

+ Anthropogenic CO₂ emissions from pre-industrial levels as outlined in the IPCC Working Group I Fifth Assessment Report. One trillion tonnes carbon = 3.67 trillion tonnes CO₂.



As part of the EEB project, the WBCSD decided to bring a Manifesto for Energy Efficiency.

Buildings to all its members, calling on them to take voluntary action. By signing the [Manifesto](#), companies “walk the talk” and send a strong message to the market, stakeholders and employees.

The Manifesto and its accompanying [Implementation Guide](#) outline five actions for companies:

1. Create a baseline for the company’s commercial buildings and set time-based energy and/or CO reduction targets in line with transformative change;
2. Publish a company policy for minimum energy performance levels in the company’s commercial buildings;
3. Define and carry out the company’s audit program and implementation strategy to meet energy targets for its commercial buildings;
4. Publish buildings’ energy use, CO emissions and progress against reduction targets annually in the company’s corporate social responsibility or other report;
5. Further promote energy efficiency in buildings among suppliers, employees and other stakeholders through advocacy, marketing activity, R&D, education and training.

140+ member companies, non-member companies and regional network partners have signed the Manifesto.

For more information on the WBCSD Manifesto for Energy Efficiency in Buildings, please see:

<http://www.wbcscd.org/work-program/sector-projects/buildings/eeb-manifesto.aspx>.

In 2014, WBCSD issued two magazines which describe the successes and challenges of companies implementing the EEB Manifesto

An [insight from companies](#), April 2014 and [A call to action](#), September 2014



In December 2015, an Energy Efficiency Toolkit for Buildings was released - A web guide for organizations to plan and initiative programs on energy efficiency. It focuses on the business case and illustrated with good practices from companies.

www.eeb-toolkit.com



Check the WBCSD website <http://www.wbcscd.org/buildings.aspx>

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This publication is released in the name of the WBCSD and its partners in the EEB Laboratory Jakarta. Like other WBCSD publications, it is the result of a collaborative effort by members of the secretariat and senior executives from several member companies and partner organizations. A wide range of members and partners reviewed drafts, thereby ensuring that the document broadly represents the majority view of the WBCSD membership and the partners. It does not mean, however, that every member company and every partner organization agrees with every word.

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ISBN 978-2-940521-61-6

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